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Ecology, population and conservation status of the Chocó Vireo *Vireo masteri*, a species new to Ecuador

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Chocó Vireo *Vireo masteri* was only recently described from Pacific premontane pluvial forest of the western Andean slope of Colombia, where it is known from three sites at 1,100–1,600 m: Alto de Pisones, Risaralda, and two in the Junín area, Nariño (Salaman 1994, Salaman & Stiles 1996). These two areas are 520 km apart, but it was postulated that the species is more or less continuously distributed where appropriate habitat remains. However, all searches and playback trials in intervening areas have failed to find the vireo. The population was estimated at 1,000–2,499 individuals and its Extent of Occurrence to be 3,105 km², which in combination with its restriction to two areas and suspected declines in Extent of Occurrence, Area of Occupancy, area and extent of habitat, and number of mature individuals, qualified the species as Endangered (BirdLife International 2004, 2006).

It was long suspected that *V. masteri* also occurs in north-west Ecuador (Moore *et al.* 1999; P. Salaman pers. comm.). However, it went unrecorded until 16 September 2004, when BP observed and tape-recorded a pair with a mixed-species flock c.3.7 km east of Alto Tambo, Esmeraldas, on the Ibarra–San Lorenzo highway (c.00°54'N, 78°30'W; c.900 m). The late P. Coopmans subsequently confirmed the identification of the tape-recordings, and P. Salaman checked BP's field description. On 24 August 2005, BP failed to relocate the species at the same site, despite repeated broadcasting of pre-recorded vocalisations. However, on 18 September 2005, following the San Lorenzo–Ibarra railroad above Alto Tambo in a north-east direction, he found another pair of *V. masteri* in a mixed-species flock (c.00°55'N, 78°29'W; c.800 m).

Between 12 January and 2 March 2006, OJ & PMV observed and tape-recorded *V. masteri* on almost all days of survey work in the Pachamama Valley (00°50'N,

78°32'W; 1,360 m), community of El Cristal, and on the río Negro Chico (00°50'N, 78°33'W; 1,130 m); the latter site is *c.* 10 km south-east of Alto Tambo. Both rivers form part of the upper río Negro drainage. Again, P. Coopmans confirmed the identification of the tape-recordings, which will be published in the revised edition of Krabbe & Nilsson (2003). These records extend the known range of Chocó Vireo by *c.* 95 km south from the río Nambi, one of the known localities of this species in Colombia.

Ecology and behaviour

In Ecuador, Chocó Vireo was recorded between 800 m and 1,500 m, in the premontane pluvial forest life zone (*sensu* Holdridge 1967). The highest record was one heard by OJ on 24 February 2006 in the Cordillera de Lachas above the Pachamama Valley (00°51'N, 78°31'W; 1,470 m). It is possible that the species is also present at slightly higher altitudes, as it is known to at least 1,600 m at Alto de Pisones (Salaman & Stiles 1996). Our data suggest that *V. masteri* occurs in a wider altitudinal range than previously reported. We recorded the species also in a broader spectrum of habitats, including primary forest on level ground and steep slopes, and at forest edges bordering pastures, roads and railways. Habitat above Alto Tambo was regrowth of intensively logged forest. Annual precipitation in our study areas might be less than at Colombian sites, with an estimated 4,500–6,000 mm in the upper río Negro drainage vs. 7,200 mm at río Nambi (Cañadas 1983, Lanfer 1995, Salaman 2001). However, the general forest structure and composition in the río Negro drainage were very similar to those described for Colombia (Salaman & Stiles 1996): very wet cloud forest with abundant palms, epiphytes, moss and ferns, a broken canopy and numerous treefall gaps, due to high rainfall and instability of soils on sloping terrain.

In the upper río Negro drainage, we found Chocó Vireo to be fairly common, with up to four singing birds recorded daily along transect routes of 1,200 m length. Weather and general activity levels of mixed-species flocks largely influenced the species' detectability. As *V. masteri* has smaller territories than many larger flock-attending insectivores (OJ & PMV unpubl.), *i.e.*, ovenbirds, woodcreepers and woodpeckers, it accompanies flocks opportunistically when they move through their territories. However, the presence of flocks of avian insectivores may be a key factor in the selection and quality of their territories, given that Chocó Vireos sang most frequently when accompanying such parties, though only a few song phrases were usually uttered. Prolonged periods of song activity, sometimes lasting *c.* 15 minutes or more, were noted when flocks crossed the presumed territory boundaries of the vireo and conspecific intruders were detected by the territory holders. Song phrases were sometimes alternated with nasal chatters, which might function as disturbance notes or alarm-calls, and are reminiscent of those of congeners, *i.e.*, Red-eyed Vireo *V. olivaceus* and Brown-capped Vireo *V. leucophrys*.

In general, *V. masteri* appears to be the only resident *Vireo* present at the known localities, with *Cyclarhis* being the only sympatric member of the Vireonidae (Salaman & Stiles 1996; pers. obs.). However, *V. leucophrys* is definitely present on the upper ridge (c.1,700 m) and north-east slope of the Cordillera de Lachas above El Cristal (P. Coopmans pers. comm.; pers. obs.), making it probable that the two come locally into contact.

Foraging birds were usually observed in pairs, most frequently at canopy and subcanopy levels between 15–25 m above ground, but sometimes much lower in treefall gaps and at forest borders; see Salaman & Stiles (1996) for details of foraging strategy.

Population estimates

BirdLife International (2006) gave a precautionary population estimate of 1,000–2,499 individuals, assuming 20% of the Extent of Occurrence may be occupied, and taking a population density of 0.9–3.5 individuals/km² (the lowest to lower quartile of ten estimates for six congeners; S. Butchart *in litt.* 2006), yielding 410–1,596 individuals. They suggested the estimate is probably best placed within the range of 1,000–2,499 individuals, because the population is likely to be at the upper end of the banded range as up to five territorial males per transect kilometre were recorded at one site.

Using the ‘Multi Time-Window Transect-Mapping’ (MTW) protocol for monitoring studies (Jahn in press), an audio-visual survey technique specifically designed to estimate absolute population densities of entire bird communities, we detected 16 territories, corresponding to 3.5 ± 0.3 (range 3.3–4.0) territories per kilometre transect within habitat ($n=96$ samples of four transects; total length 4.8 km, 4.5 km within forest; altitudinal range 1,085–1,370 m; standardised survey effort 46.7 ± 2.9 hours per transect; total effort 204 hours, corresponding to 34 man-days, including six samples repeated due to rain). Absolute population densities can be estimated on the basis of effectively surveyed areas, which in turn can be calculated with the help of species-specific and habitat-specific ‘detection threshold distances’ (DTDs; *cf.* Jahn in press). In the case of *V. masteri* we estimated a site-specific average DTD of 80 m (range 50–110 m), considering that habitat structure, topography and noisy rivers hindered detection at longer distances. Given that repeated sampling of the same transect increases the probability of detection of additional territories at the periphery of the transect area, we calculated the ‘effective DTD’ to be 104 m, using an empirical factor of 1.3 (*cf.* Jahn in press). Consequently, the effectively surveyed area within habitat was c.100.4 ha for the species (note that, in total, only four semicircles were considered at the transect ends because the transects were organised in pairs of more or less continuous trails of 2,400 m at both study sites). Total population density within forest can thus be calculated as 15.9 ± 1.4 (range 14.7–17.8) territories/km², corresponding to 31.8 ± 2.8 mature individuals/km². The available area per territory was 6.3 ± 0.5 ha,

which might be equal (if occupancy was 100%) or larger than mean territory size (Jahn in press).

We estimate the Chocó Vireo's Extent of Occurrence (*cf.* IUCN 2001) in Ecuador to be $c.825 \text{ km}^2$ by overlapping the extent of the premontane pluvial forest life zone (*sensu* Cañadas 1983) and the species' presumed altitudinal range (800–1,600 m) with remnant forest cover (Sierra 1999). This area stretches as a narrow band from the Colombian border to the río Barbudo (Cordillera de Toisán) in the south, and covers parts of Carchi and Esmeraldas. Considering that our population density estimates are based on only four transects in the optimal altitudinal range of the species and that it might be much rarer at higher and lower elevations, we calculate the total potential population for Ecuador to be $16,400 \pm 1,500$ mature individuals (by multiplying half of the Extent of Occurrence by 31.8 ± 2.8 individuals/ km^2 and the other half by 0.25 times the optimal value). Repeating the same procedure for the presumed Extent of Occurrence in Colombia ($3,105 \text{ km}^2$ *sensu* BirdLife International 2004, 2006), the potential population there would be $61,600 \pm 5,500$, resulting in $78,000 \pm 7,000$ mature individuals on the global level. However, this assumes that the species is continuously distributed within its Extent of Occurrence, which might not be the case. Furthermore, existing data suggest that the species can sustain only very low population densities in secondary forest and that it is prone to disappear from severely fragmented habitat mosaics. The true total population size is therefore likely to fall well below the above figure. We therefore assume a 20% occupancy of the Extent of Occurrence (*cf.* BirdLife International 2006), i.e. 165 km^2 for Ecuador and 621 km^2 for Colombia. This gives precautionary population estimates of $3,300 \pm 300$ mature individuals in Ecuador, $12,300 \pm 1,100$ in Colombia, and $15,600 \pm 1,400$ at the global level.

Conservation status in Ecuador

Forest in the Pachamama Valley is very poor in exploitable tree species, making cattle-ranching the only profitable economic activity in this very wet and remote area. Disputes over land ownership are epidemic in Esmeraldas, forcing local people to establish pastures even if they cannot afford to purchase a cow. Our local guides from El Cristal were convinced that all the forest in the valley might be converted within the next few years.

The Fundación Para El Desarrollo Forestal recently purchased the land between the village of Alto Tambo and our base camp west of the río Negro Chico. Thus, it will depend largely on future forestry practices (intensive vs. selective harvesting schemes; natural-forest management vs. plantations of exotic tree species), whether the habitat remains appropriate for Chocó Vireo.

Both study sites are located only a few kilometres north of the Cotacachi-Cayapas Ecological Reserve (243,638 ha; altitudinal range 80–4,900 m), and form part of the enlarged Important Bird Area of the same name (IBA EC037; Freile & Santander 2005). In our estimate, about 50% of the species' Extent of Occurrence in

Ecuador is within the reserve. However, even if *V. masteri* is present there, this would not guarantee the species' survival in the country. Several communities at the periphery of the reserve, including some people of Alto Tambo, are planning to invade large portions of the protected area, with the declared aim to sell the land subsequently to conservation organisations or to receive payments for environmental services. Unless the Ecuadorian government reacts decisively and stops any invasions, the very integrity of the Cotacachi-Cayapas Ecological Reserve might be at stake. The reserve's management plan is currently under revision and we hope that the document will address these (and other) threats and potential solutions.

Some of the presumed Ecuadorian range of Chocó Vireo is within the Awá Ethnographic Reserve (101,000 ha; Esmeraldas, Carchi, Imbabura). However, the latter is not a nature reserve but was established to maintain the traditional culture of the indigenous Awá people. Hence, the area is inhabited and subsistence agriculture, hunting and selective logging are common and legal. It is unclear to what extent conservation of the area's biodiversity is guaranteed.

The altitudinal range (30–650 m) of the Biological Corridor Awacachi (c.10,000 ha), which is managed by the SIRUA Foundation, and interconnects the Cotacachi-Cayapas Ecological Reserve and the Awá Ethnographic Reserve, is sited too low to protect any populations of Chocó Vireo.

Reassessment of threat status

Our data suggest that the species' population size is probably too large to trigger criterion C or D1 of the IUCN Red List criteria (IUCN 2001). However, the revised estimate for the Extent of Occurrence (3,932 km²) is still smaller than the 5,000 km² threshold for Endangered (criterion B1), despite the range extension into north-west Ecuador. Furthermore, the species is known only from three separate 'locations,' qualifying for sub-criterion 'a,' and continuing decline is observed, inferred and projected (sub-criterion 'b') in the following: (i) Extent of Occurrence; (ii) Area of Occupancy; (iii) area, extent and quality of habitat; and (iv) number of mature individuals. In conclusion, the species should remain Endangered under criterion B1ab (i,ii,iii,v). At the national scale, the species also qualifies as Endangered in Colombia and Ecuador.

Conclusion

The global population of *V. masteri* might be considerably larger than previous estimates suggested. However, unless additional subpopulations are discovered, its threat status (Endangered) should not be changed. Known populations should be closely monitored as habitat conversion is affecting an increasing portion of the species' restricted range and in order to evaluate the population density estimates presented here. Transect-mapping could also be used to search for the vireo north and south of known localities.

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